

PATENT COOPERATION TREATY

From the Japan Patent Office (INTERNATIONAL SEARCHING AUTHORITY)

PCT

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(Implementing Regulation 40 bis)
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) 26.4.2005

Applicant's or agent's file reference

F622PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/JP2005/000037

International filing date (day/month/year)

05.01.2005

Priority date (day/month/year)

19.01.2004

International Patent Classification (IPC) Int. Cl. H03H9/145, H01L41/09, 41/18, 41/22, H03H3/08, 9/25

Applicant

Murata Manufacturing Co., Ltd.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220

3. For further details, see notes to Form PCT/ISA/220

Date of completion of this opinion

12. 04. 2005

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/JP2005/000037

Box No. I

Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purpose of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-29	YES
	Claims		NO
Inventive step (IS)	Claims	2-3, 6-7, 14, 16, 23	YES
	Claims	1, 4-5, 8-13, 15, 17-22, 24-29	NO
Industrial applicability (IA)	Claims	1-29	YES
	Claims		NO

2. Citations and explanations:

Claims 1 and 8

Document 1: WO 1998/52279 A1 (Hitachi, Ltd.)

November 19, 1998

Full text, Figs. 3 to 5 and 11 to 16

Discloses a boundary acoustic wave device including a piezoelectric substrate (LiNbO₃ or LiTaO₃), a SiO₂ layer, a Si layer, and an interdigital transducer disposed between the SiO₂ layer and the Si layer; and boundary acoustic wave device including a piezoelectric substrate, a SiO₂ layer, a Si layer, an interdigital transducer disposed between the SiO₂ layer and the Si layer, and a resin layer.

Document 2: JP 2003-017980 A (Fujitsu Limited)

January 17, 2003, [0035], Figs. 11 and 13

& US 006437479 B1

Discloses the use of an epoxy resin as a sound absorbing material.

Document 3: JP 7-154185 A (NEC Corporation)

June 16, 1995, [0074]

& US 005939817 A1

Discloses the use of silicon as a sound absorbing material.

As disclosed in, for example, Documents 2 and 3, it has been known that resin or silicon can be used as a sound absorbing material. It is therefore readily considered that the Si layer and the resin of the boundary acoustic wave device disclosed in Document 1 can serve as a sound-absorbing material.

Therefore Claim 1 does not involve an inventive step.

Claims 2 and 3

No documents cited in the international search report disclose or suggest that "the acoustic velocity of the transverse waves in the sound-absorbing layer is lower than the acoustic velocity of the transverse waves in the first medium layer and/or second medium layer that has the sound-absorbing layer" or that "the acoustic velocity of the longitudinal waves in the sound-absorbing layer is lower than the acoustic velocity of the longitudinal waves in the first medium layer and/or second medium layer that has the sound-absorbing layer".

Claim 4

Document 4: JP 2003-512637 A (Tournois, Pierre)

April 2, 2003, [0046]-[0047]

& US 006737941 B1

Discloses that the velocity of transverse waves in Si is 5450 m/s and the velocity of transverse waves in LiNbO₃ is 4850 m/s.

It is apparent from Document 4 that in the boundary acoustic wave device of Document 1, the velocity of transverse waves in the Si layer is 1.12 times that in the LiNbO₃ layer.

Therefore, Claim 4 does not involve an inventive step.

Claim 5

Document 5: JP 9-248908 A (Toshiba Corporation)

September 22, 1997, [0029]

Discloses that quartz glass has an acoustic impedance of 15×10^5 kg/m²·s, and that silicon has an acoustic impedance of 20×10^6 kg/m²·s.

It is apparent from Document 5 that in the boundary acoustic wave device of Document 1, the acoustic impedance of the Si layer is 1.33 times that of the SiO₂ layer.

Therefore, Claim 5 does not involve an inventive step.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: V.2

Claims 6 and 7

No documents cited in the international search report disclose or suggest that "the sound-absorbing layer comprises the same type of material as the first medium layer and/or the second medium layer", or that the structure further includes "a low attenuation constant layer outside the sound-absorbing layer, the attenuation constant layer having a lower attenuation constant for acoustic waves than the sound-absorbing layer".

Claim 9

Document 6: JP 2001-015649 A (Kyocera Corporation)

January 19, 2001, Claim 1, [0026]-[0031], [0049]

Discloses that a filler is added to a resin, such as epoxy.

Document 7: JP 2002-346345 A (Toray Industries, Inc.)

December 3, 2002, [0018]-[0019]

Discloses that a filler is added to a resin, such as epoxy, if necessary.

As disclosed in, for example, Documents 6 and 7, resins containing a filler have been known.

Therefore Claim 9 does not involve an inventive step.

Claim 10

Document 1 discloses that the SiO₂ layer and the Si layer are disposed in a region opposing the boundary acoustic wave propagation path.

Therefore Claim 10 does not involve an inventive step.

Claim 11

Document 8: CD-ROM that has recorded the Description and drawings originally attached to the request of Japanese Utility Model Registration Application No. 4-037144 (Japanese Utility Model Registration Application Publication No. 6-002823) (Seiko Epson Corporation)

January 14, 1994, [0008]-[0022], Figs. 1 to 3

Discloses that an electrical shielding effect is produced by providing an electrically conductive film to a surface acoustic wave device.

Persons skilled in the art can easily arrive at the structure in which the electrically conductive film of Document 8 is deposited on the Si layer or the resin layer of the boundary acoustic wave device of Document 1.

Therefore Claim 11 does not involve an inventive step.

Claim 12

Document 9: JP 10-163789 A (Sanyo Electric Co., Ltd.)

June 19, 1998, [0022]-[0030], Figs. 5, 7, and 8

Discloses a surface acoustic wave device including a through-hole electrode passing through a piezoelectric substrate, and an external electrode disposed on the external surface of the surface acoustic wave device, connected to the through-hole electrode.

Persons skilled in the art can easily arrive at the structure in which a through-hole electrode and an external electrode similar to those of Document 9 are provided to the piezoelectric substrate of the boundary acoustic wave device of Document 1.

Therefore Claim 12 does not involve an inventive step.

Claim 13

Document 9 discloses that a plurality of solder balls are placed in the through hole.

Therefore Claim 13 does not involve an inventive step.

Claim 14

No documents cited in the international search report disclose or suggest that "the through-hole electrode of the first medium layer and the through-hole electrode of the second medium layer are formed in a discontinuous manner".

Claim 15

Document 9 discloses that a wrap-around electrode connected to an interdigital transducer is provided on the external surface of the surface acoustic wave device.

Therefore Claim 15 does not involve an inventive step.

Claim 16

No documents cited in the international search report disclose or suggest the boundary acoustic wave device "further compositing a connection electrode connected to the electrode disposed at the interface, wherein the boundary acoustic wave device has steps on a side surface intersecting the interface and the connection electrode is drawn to the steps, and wherein the wiring electrode is extended to the steps and connected to the connection electrode at the steps".

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Continuation of: V.2

Claims 17 and 18

Document 10: JP 2002-009584 A (Hitachi, Ltd.)

January 11, 2002, Claim 13, [0004]-[0005], [0012]-[0063], Fig. 8

Discloses that delay time temperature coefficient is reduced by providing to a surface acoustic wave device a layer having a linear expansion coefficient lower than the piezoelectric substrate, or a layer having a linear expansion coefficient with the opposite sign to that of the piezoelectric substrate.

Persons skilled in the art can easily arrive at the structure in which a layer similar to the layer of Document 10 is provided to the boundary acoustic wave device of Document 1.

Therefore Claims 17 and 18 do not involve an inventive step.

Claim 19

Document 11: Rika-Nenpyou, National Astronomical Observatory of Japan, 1997 desktop version

November 30, 1996, ISBN 4-621-04266-1, p. 485

Shows that silica has a thermal conductivity of 168 W/m·K, and quartz glass has a thermal conductivity of 1.4 W/m·K.

As is clear from Document 11, the Si layer of the boundary acoustic wave device of Document 1 has a higher thermal conductivity than the SiO₂ layer. Accordingly it is apparent that the Si layer has heat dissipation ability.

Therefore Claim 19 does not involve an inventive step.

Claim 20

Document 12: JP 59-006611 A (Clarion Co., Ltd.)

January 13, 1984, p. 3, Figs. 4 to 7

& US 004625184 A1

Discloses a matching circuit formed by disposing a rectangular pattern or strip lines between a piezoelectric thin film and an elastic substrate.

Persons skilled in the art can easily arrive at a matching circuit formed between the piezoelectric substrate and the SiO₂ film of the boundary acoustic wave device of Document 1.

Therefore Claim 20 does not involve an inventive step.

Claim 21

Document 1 discloses that the SiO₂ layer has a thickness of 0.375λ or more and the Si layer has a thickness of 0.25λ or more.

Therefore Claim 21 does not involve an inventive step.

Claim 22

Document 1 discloses a boundary acoustic wave device including a multilayer composite of a Si layer and a resin layer, exhibiting a sound-absorbing effect.

Therefore Claim 22 does not involve an inventive step.

Claim 23

No documents cited in the international search report disclose or suggest that "the multilayer structure of the sound-absorbing layer includes a plurality of sound-absorbing material layers, and a sound-absorbing material layer close to the second medium layer has an acoustic characteristic impedance between the acoustic impedances of the second medium layer and a sound-absorbing material layer farther from the second medium layer".

Claims 24 and 25

Document 1 discloses a boundary acoustic wave device whose boundary acoustic wave chip is mounted on a ceramic substrate with a bump. Also, it discloses that an elastic material is provided to the mounting surface side for reducing stress.

Therefore Claims 24 and 25 do not involve an inventive step.

Claim 26

Document 1 discloses a method for manufacturing a boundary acoustic wave device including the steps of providing an interdigital transducer on a piezoelectric substrate, depositing a SiO₂ film, and depositing a Si film.

Therefore Claim 26 does not involve an inventive step.

Claim 27

Document 13: JP 2002-222899 A (Matsushita Electric Industrial Co., Ltd.)

August 9, 2002

Claims 10 and 11, [0057]-[0063]

Discloses that air in a resin film is removed when the resin film is formed in an electronic component.

Persons skilled in the art can easily arrive at the thought that the step of removing air from the resin layer, as in Document 13, is added to the step of forming the resin layer of the boundary acoustic wave device of Document 1.

Therefore Claim 27 does not involve an inventive step.

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In case the space in any of the preceding boxes is not sufficient.

Continuation of: V.2

Claims 28 and 29

Document 14: JP 8-265089 A (Murata Manufacturing Company, Ltd.)

October 11, 1996, [0030]-[0038]

Discloses that when a thin film is formed in a surface wave device, the thin film is formed to a mother substrate, and then the mother substrate is divided into surface wave devices.

Document 15: JP 9-046156 A (Kinseki, Limited)

February 14, 1997, Claim 3, Fig. 4

Discloses that when a protective film is provided to a surface acoustic wave device, a piezoelectric wafer is divided into devices and then the protective film is formed.

As disclosed in, for example, Documents 14 and 15, persons skilled in the art can appropriately determine whether the Si layer or the resin layer of the boundary acoustic wave device of Document 1 is formed to a mother state before dividing into devices or it is formed after dividing into devices, according to the design.

Therefore Claims 28 and 29 do not involve inventive step.